SITE: Florida Phosphate
BREAK: 17.8
OTHER: V.49

Nov. 25, 1998

10518258

Mr. Germain Gaboury
(b) (6)

Dear Mr. Gaboury,

This is in response to your concerns resulting from a Fact Sheet entitled "Radiation on Reclaimed Phosphate Lands" by Marvin Resnikoff, Ph.D. and Stanley Waligora, CHP, which was distributed to residents of Floral Park where your home is located. In dealing with this issue I'd like to address each of the following types of radiation exposure seperately: 1. Gamma Exposure 2. Radon Exposure 3. Ingestion of Garden Crops and 4. Ingestion of Fish.

Gamma Exposure

Gamma exposure rate measurements were made in and around your home. A gamma measurement was made in the center of each room. These measurements **ranged from 12 to 32 micro-roentgens per hour (uR/hr) with a mean (average) of 26 uR/hr**. Measurements around the perimeter of your home ranged from 13 to 33 uR/hr with a mean of 19 uR/hr. For a point of reference, the average background gamma exposure rate for the state of Florida is accepted to be 6 uR/hr. The level of gamma exposure in all areas around your home exceeds the mean for the state.

The reason for these elevated levels is the presence of naturally occurring radioactive materials in the ground beneath your home. Uranium occurs naturally with the phosphate deposits in central Florida. The mining of phosphate and the reclamation process in the area where your home is located left some of these radioactive materials closer to the surface.

The variations in the exposure rates at your home appear to be related to shielding from concrete and fill used in construction of the back porch and in leveling the yard around your home as well as to variations in the quantity of the radioactive materials present and their proximity to the surface.

In determining an estimate of the dose resulting from the gamma exposure rates encountered in and around your home, an estimate of occupancy times is necessary. The "fact sheet" referred to the results of family interviews at Floral Park which stated that on the average, 25 hours per week were spent away from the Park, 25 hours per week were spent in their yard, and the rest of the time was spent in their home. Based on this information, and the measurement results for your home, the estimate of your total gamma dose from this source is about 193 millirem (mrem) per year or approximately 140 mrem per year above background if 6 uR/hr is considered the background exposure rate. **As a "worst case" scenario, if you spent all your time in your home, your dose would be about 175 mrem/yr above background or about 228 mrem/yr including background.**

In the fact sheet references are made to dose rates exceeding regulatory limits. In particular, a regulatory limit of 100 mrem/yr. is stated. This is misleading and needs clarification. There is no regulation limiting the dose that an individual receives from natural background sources. There are regulatory limits with regard to the activities of those licensed to use radioactive materials. No radioactive materials licensee can conduct activities which result in a member of the public receiving a dose greater than 100 mrem/yr. This does not apply to your situation. The mining and reclamation process in the phosphate lands of central Florida has never been considered a radioactive materials licensed activity.

Even though there are no regulatory limits for exposure from natural background sources, there are recommendations. The National Council on Radiation Protection and Measurements, in their Report No. 91 entitled Recommendations On Limits For Exposure to Ionizing Radiation, recommend that **remedial action be undertaken when the average annual effective dose equivalent from external exposure (excluding medical, but including naturally occurring sources) continuously exceeds 500 mrem. Your annual dose from naturally occurring external sources is well below this level.**

Radon Exposure

Enclosed with this letter is a Radon Measurement Report for the short-term radon test that was performed in your home. As you can see, **the radon level measured of 4.6 pCi/l (picocuries per liter) exceeds the recommended remediation level of 4.0 pCi/l set by the E.P.A.** On the reverse side of the attached report are the recommendations for follow-up testing and remediation. Since the test performed in your home was a short-term screening measurement under closed-house conditions, it does not necessarily reflect the average annual radon exposure that you are receiving. To get a better indication of that level, I **recommend performing a long-term (3 to 6 months) follow-up radon measurement in your home under normal living conditions (ie. windows closed or opened depending on lifestyle). Whether or not remedial action should be taken would be based upon the results of this follow-up measurement.**

I have also enclosed the EPA publication, A Citizen's Guide to Radon. The risk associated with radon exposure is put into perspective on page 12 of this booklet. As can be seen, **a person exposed to a 4 pCi/l radon level over their entire lifetime would have an increased lung cancer risk of 2 in 1,000.**

Ingestion of Garden Crops

In addressing your concerns over the radiation you could receive from eating crops out of your garden, I would point you to a research paper entitled, Radioactivity in Foods Grown on Mined Phosphate Lands, Oct. 1990. This study looked at 70 food samples collected from five different parcels of land in the Central Florida phosphate area. These food samples were analyzed for naturally occurring radioactivity as was the soil they were grown in.

The summary of this report points out that **a person who obtains all of the foods sampled in this study from reclaimed clay lands would receive only about 2.7 mRem per year more than someone obtaining all of these crops from non-reclaimed land. To put this into perspective, the 2.7 mRem is approximately the equivalent exposure one would receive from an airline flight from Tampa to Los Angeles, a rather insignificant amount.**

Ingestion of Fish

Regarding the fish eaten from the lake behind your home, I could only locate one study relating to radioactivity in fish from phosphate mined lands. This study, Radium-226 in Central Florida Aquatic Organisms, Aug. 12, 1981, found that **the average radium activity for fish taken from mined lands was double the levels seen in fish from other locations**. Three species of fish were studied: Mosquito fish, bluegill and largemouth bass. Of these three, the mosquitofish had the highest average radium content with bluegill next and bass the last. The reason for the differences in the average radium content appears to be due to the differences in the size of the three species and the ratio of bone to soft tissue. Mosquitofish have more bone for their size than bass, and therefore, a higher average radium content since radium is concentrated in the bone.

Although the authors recommend further study of the use of fish obtained from mined land in human diet, they do make the following statement: **"Based on our present level of understanding, it seems that if only larger fish are eaten by man, if the majority of radium-226 is in the bone, and if fish constitute a small part of human diet, there should be minimal hazard to man."**

Summary

Of the four areas of concern addressed above, only the radon issue would appear to warrant attention. Generally, mobile homes have very low radon levels due to the passive ventilation in the crawl space, diluting the radon gas before it has a chance to enter the home. It may be necessary in your case to provide some active ventilation within the crawl space to adequately disperse the radon.

If I can be of any further assistance to you regarding these matters, please feel free to phone.

Sincerely,

Tom McNally

Tom McNally

Publication No. 05-028-088

RADIOACTIVITY IN FOODS GROWN ON MINED PHOSPHATE LANDS

FIPR

Florida Institute of Phosphate Research

Prepared By

Post, Buckley, Schuh, & Jernigan, Inc.

Under a Grant Sponsored by the
Florida Institute of Phosphate Research
Bartow, Florida

October 1990

SUMMARY

Post, Buckley, Schuh & Jernigan, Inc. (PBS&J) was retained by the Florida Institute of Phosphate Research to study the radioactivity in foods grown on mined phosphate lands in the central Florida phosphate district. This study was a follow-up to a previous study of radioactivity in foods in which over one hundred food samples were collected from sixty two land parcels. While the initial study surveyed radioactivity in foods on a variety of land types including unmined lands and mined lands, this current study concentrated on lands which were reclaimed after phosphate mining. Since lands reclaimed from clay settling areas will constitute the majority of lands to be reclaimed, this current study concentrated mostly on foods grown on reclaimed clay lands.

Approximately seventy individual food samples were collected from five land parcels in the central Florida phosphate district and subjected to radioassay for radium-226, lead-210 and polonium-210. Corresponding soil samples were collected and analyzed for these radionuclides and also for a variety of soil chemistry parameters. The results of the radioactivity and soil chemistry analyses of these samples were integrated into the data base which had been created from the initial study and a variety of statistical analyses were conducted on this integrated data set. The results of these analyses indicated, as in the initial study, that concentrations of radium-226 and lead-210 observed in foods grown on mined phosphate lands were statistically higher than concentrations of these radionuclides exhibited in foods grown on unmined phosphate lands. Concentrations of polonium-210 observed in these foods were found to be extremely low; in fact, a substantial number of the measurements for polonium-210 were below the limit of detection of the analytical methodology.

Although the radioactivity concentrations measured in foods grown on mined phosphate lands were found to be statistically higher than in foods grown on other lands, the radiation dose to the consumers of these foods was found to be only a small fraction of the dose received by an average individual from other environmental sources of radioactivity. The study evaluated the dose to a hypothetical person who obtains all of the foods sampled in this study from reclaimed clay lands and the remainder of his diet from the general food pool. This person is estimated to receive 19.1 mrem per year in committed effective dose equivalent from the ingestion of the radionuclides reported in this study. This is only 2.7 mrem per year more than the estimated radiation dose to a similar individual who obtains all of his foods from lands unaffected by phosphate deposits or phosphate mining. Both of these dose levels are quite low and are not considered to be a health hazard.

CONCLUSIONS/RECOMMENDATIONS

CONCLUSIONS

Based on the results described in the previous sections, it can be concluded that foods grown on mined phosphate lands (including reclaimed, debris and clay lands) exhibit higher concentrations of radium-226 than foods grown on unmined lands (including phosphate mineralized and unmineralized lands). This is consistent with the findings of the initial study. Since this study did not investigate levels of lead-210 and polonium-210 in foods grown on unmined lands, conclusions regarding relative concentrations of these radionuclides in foods grown on mined and unmined lands cannot be drawn. The higher concentrations exhibited by those foods grown on mined phosphate lands result in higher rates of ingestion for radium-226 and higher radiation doses to those individuals ingesting these foods. The doses however are quite low, even for the hypothetical maximum individual who consumes all study foods from clay lands. The estimated doses, even to the maximum individual, would be a small fraction of natural exposure to environmental radioactivity and would not be considered to be a health hazard.

The statistical analyses which were conducted on the data generated from this and the previous study indicate that radium-226 and lead-210 in foods vary approximately as the square root of radium-226 and lead-210 in soil. The results for polonium-210 were inconclusive due to the large number of measurements which were below the limit of detection of the analytical methodology. The effects of soil chemistry on the uptake of radium-226 and lead-210 by foods depended on the statistical model employed. However, in the case of radium-226, food concentrations were positively correlated with pH in all of the models employed and negatively correlated with cation exchange capacity for selected models. For lead-210, the soil chemistry data did not present a clear picture of those factors which might affect lead-210 uptake in foods.

It is important to note that the models which were developed from the statistical data base generated for this and the previous study can only be used for samples drawn from locations similar to those utilized in these studies and for foods grown in these studies. These models represent only a few of the models which are available from the analysis of these data. The integrated data base which was used in this study has been provided to the Florida Institute of Phosphate Research in a form suitable for analysis on the Statistical Analysis System.

RECOMMENDATIONS

Based on the low radiation doses which have been estimated from the data collected in this and the previous study, a recommendation to limit food production on mined phosphate lands does not appear to be warranted. Although the foods collected from mined lands did exhibit statistically higher levels of radium-226 than similar foods collected on unmined lands, the resulting radiation doses from the consumption of these foods are low. The authors do however recommend that, all other things being equal, if clay lands are to be used for commercial food production, preference be given to those foods (such as garden fruits and those in the general category) which exhibited the lowest concentrations of radioactivity.

WAYNE R. MARION

RADIUM-226 IN CENTRAL FLORIDA AQUATIC ORGANISMS

by

Sam B. Upchurch
Joe R. Linton
Dale D. Spurgin
H. Ralph Brooker

University of South Florida
Tampa, Florida 33620

August 12, 1981

All three can contain bound sediment in small amounts, but to cause such high activities the bound sediment would be detectible. Average concentration factors for plants are 232,000 for the filamentous algae and 15,200 for the other plants.

Herbivores were difficult to obtain and so a small sample set is represented. Insufficient samples lead to some anomalous results. For example, the herbivorous fish from the control area is from site 10, which we feel is contaminated by radium from fertilizer. Average concentration factor for the herbivores is 460, which is high relative to values reported in the literature (see above).

There is a sufficient sample set to evaluate the impact of mining on carnivorous fish. Carnivores were emphasized in the sampling because they constitute most of the food fish of importance to man. Average radium activities in carnivorous fish as a function of land use are shown in Table 4. In the control areas these fish average 210 pCi/kg, which gives an average concentration factor of 323. This value is slightly higher than concentration factors reported by Polikarpov (1966) and considerably higher than those of Tsivoglou and others (1958) and Anderson and others (1963) for fish above the uranium mill on the Animas River. These higher values can be attributed to the fact that several fish samples from Site 10 appear to be somewhat high in radium. We attribute this to enrichment of the lake by radium-bearing phosphatic fertilizers. Thus, the control area averages are higher than anticipated.

Unmined, phosphate-bearing terranes should contain animals that have slightly higher burdens of radium because of natural weathering of phosphate rock by surface and ground waters. The average carnivorous fish contains 200 pCi/kg, which is the same as the control sample average. Since we feel that the control samples are somewhat suspect, one could conclude that the unmined, phosphatic terranes do have slightly higher radium activities. The Manatee River system, particularly, is enriched by fertilizer runoff (Tampa Bay Regional Planning Council, 1978), so radium activities in fish in this group may be high compared to totally unaffected drainages. The average concentration factor for carnivorous fish is 500, which is high compared to literature values (e.g., Anderson and others, 1963) and is indicative of radium buidup as a result of natural weathering and fertilizer use.

The average radium activity for fish taken from mined lands is 482 pCi/kg, which is double levels seen in either the control areas or unmined, phosphatic terranes. We conclude that this represents added exposure due to disruption during mining. The average concentration factor for radium in fish for this land use is 679, which is double the concentration factor for fish from control areas and well over the concentration factor for unmined, phosphatic terrane. There is a clear indication. therefore, that phosphate mining increases the radium content of carnivorous fish. Since it appears that the control areas and unmined, phosphatic terrane study areas are affected by some degree of fertilizer use, the numbers for radium-226 activities and concentration factors represent a conservative estimate of the degree of impact of phosphate mining.

One could argue that the sample set used in the averages reported in Table 4 is invalid because comparisons are made that include more than one species. Three species were sampled at virtually all sites, and allow direct comparisons between land uses. Table 5 shows the radium-226 activities for three species, Gambusia affinis (mosquitofish), Lepomis macrochirus (bluegill), and Micropterus salmoides (largemouth bass).

Of the three species, Gambusia is consistently higher in radium-226 than the other two species. There are differences in food sources between

Table 5. Radium-226 activities (pCi/kg) in selected species of fish by land use.*

Species	Control areas	Unmined, phosphatic terrane	Mined lands	River draining mined land
Gambusia affinis	432.7 (2)**	786.3 (1)	993.6 (3)	513. (1)
Lepomis macrochirus	165.8 (4)	120.0 (3)	598.6 (5)	195.5 (1)
Micropterus salmoides	16.2 (1)	55.4 (2)	84.2 (3)	41.9 (1)

* See Table 4 for sample sites assigned to each land use.
** Number of samples used in determining means.

these three species, so the differences in radium content may be related to position in the food chain. Since there is no indication that biomagnification is present, these differences in radium activity are due to variations in size of the three species. Gambusia adults are the smallest of the three species, while Micropterus adults are largest. A good explanation of the differences in radium content, therefore, is the ratio of bone to soft tissue in each species. Gambusia has relatively more bone for its size than does Micropterus. Thus, one would expect that the radium-226 activities, which are controlled by incorporation in bone, would be greatest on a per unit weight basis in the smaller individuals. This phenomenon will be discussed in depth below.

There is a clear trend in the averages shown in Table 5 relative to land use. Gambusia from unmined, phosphatic terrane is represented by only one sample, so the radium-226 activity represented may be high. Otherwise, there appears to be little difference between samples from the control areas and unmined, phosphatic terranes. Remember that some of the control samples appear contaminated by fertilizer runoff, so this lack of significant difference may not be real. There is a difference in radium activity in fish between these two land uses and mined lands. All species show significantly higher activities in mined land areas. The river draining the mined land category appears similar to the control and unmined, phosphatic terrane samples, but remember that there is only one sample per species in this category. The numbers cannot be considered representative with such a small sample size. Clearly, phosphate mining has an impact on the average radium content of fish.

Affect of Size on Radium Content

The data presented in Table 5 clearly suggest that the larger species of fish contain less radium on a per unit weight basis than do small fish. To evaluate this trend, two analyses were made. The first (Figure 3) was to plot weight of all fish samples versus radium activity on a per unit weight basis. X's on Figure 3 represent Micropterus, squares present Lepomis, and +'s represent all other fish species. There is a distinct relationship between size and radium activity, with smaller individuals containing the greatest variation and highest radium activities on a per unit weight basis. Small individuals *may* not contain high activities, but no large individuals contain high activities.

Examination of the raw data (Table 3) and sample weights indicates that there are two trends present in the sample set. First, many of the smaller species do contain higher radium-226 activities, which suggests that small fish species accumulate radium in greater relative amounts. This can probably be attributed to greater bone to soft tissue ratios in these species. However, within a given species at a given locality, the trend is the opposite. That is, small individuals of a given species contain less radium per unit weight relative to larger, more mature individuals. Thus, there are significant differences in the manner of radium concentration between species of fish and in the amount of radium per unit weight within species. In order to best evaluate the impact of land use on radium content in fish, one should account for the variation between species by comparing the same species at each locality. To account for differences in size of individuals within the species of concern, the expected radium content should be predicted as a function of weight. This latter approach has been attempted by Morgan (1964; cited in Pentreath, 1977), who showed that cesium-134 accumulation in marine fish is a linear function of sample weight. He also showed that the linear relationship varied in intercept, but not slope, from species to species.

A linear regression of weight versus radium activity for Lepomis at site 10, one of the control sites, gives a correlation coefficient of 0.9833. This is significant with less than a 5 percent chance of error and indicates that radium activity is directly related to weight. A similar analysis of Lepomis from mined lands gives a correlation coefficient of 0.317, which is not significant and indicates that bluegills in the mined lands are taking on radium in amounts disproportionate to their weights.

Another way of examining this problem is to use the linear relationship between weight and radium activity derived for Lepomis in the control areas. This relationship can be used to predict the radium activity of individuals of Lepomis according to the regression equation

$$\text{Radium activity (pCi/kg)} = 10.20 \times \text{dry weight} - 156.45.$$

This equation explains 96 percent of the variability in radium activities in the control area Lepomis. Using the equation to predict radium activities in Lepomis from the unmined, phosphatic terrane and Alafia River samples indicates that the radium activities are either closely approximated or over estimated (Fig. 4). That is, the two samples from Site 8 actually contain 117.2 and 61.8 pCi/kg radium-226. The regression equation predicts that these samples should have 173.0 and 345.4 pCi/kg, respectively. Over prediction by the equation is due in part to contamination of the samples from the control area by fertilizer runoff. Samples from Site 5 (Alafia River) and Site 7 (Lake Manatee) were predicted by the equation!

The fact that we can extend prediction of radium activities in fish from the control area to the unmined, phosphatic terrane samples (Fig. 4) suggests that this approach has some validity and that the control area is, in fact, contaminated to about the same degree as Lake Manatee and the Alafia. Over prediction of Site 8 (Lake Myakka) samples supports the notion that Lake Myakka is not contaminated to the degree of the other sites.

If one takes that same approach with Lepomis samples from mined lands, the equation under estimates radium activities! True radium activities average 479 pCi/kg higher than those predicted (Fig. 4). This suggests that Lepomis from mined lands carry higher body burdens of radium-226 than would be expected, regardless of size of the individual.

Impact on Aquatic Life

There is little information concerning the impact of chronic exposure of aquatic organisms to radium-226. Based on our present level of understanding, it seems that if only larger fish are eaten by man, if the majority of radium-226 is in bone, and if fish constitute a small part of human diet, there should be minimal hazard to man. It seems that fish from most of the environments sampled are relatively low in radium anyway. Fish from lands affected by phosphate mining constitute the only area of concern and a study should be undertaken to determine use of fish in human diet from these areas.

Pick up Fri
@ 2:00 pm

SAMPLE INFORMATION
(For "E-PERM" Radon Tests)

FIELD INFORMATION

Name: Germaine GABOURY

Address Tested: (b) (6)

City: Bartow State: FL Zip: 33830 Phone: (b) (6)

Reason For Test: ✓ Real Estate Other: ____
(Check One)

Device #: SJ 3175 Initial Volt: 533 Final Volt: 466 uR/hr: 12 (4633) 20

Start Date: 11/16/98 Time: 14:13 : Stop Date: 11/21/98 Time: 13:17

Location: LIV. RM Comments: ____

Device #: SJ 3257 Initial Volt: 588 Final Volt: 517 uR/hr: 20

Start Date: 11/16/98 Time: 14:13 : Stop Date: 11/21/98 Time: 13:17

Location: LIV. RM Comments: ____

Device #: ____ Initial Volt: ____ Final Volt: ____ uR/hr: ____

Start Date: __/__/__ Time: __:__ : Stop Date: __/__/__ Time: __:__

Location: ____ Comments: ____

Radon Measurement Specialist: Tom McNully

EPA RMP ID #: N/A State of Fla. Cert. #: R0857

****

LABORATORY INFORMATION

Device #: SJ 3175 Sample #: PE2154 # Hours: 119.1 Result: 4.4 pCi/l

Device #: SJ 3257 Sample #: PE2154A # Hours: 119.1 Result: 4.7 pCi/l

Device #: ____ Sample #: ____ # Hours: ____ Result: ____ pCi/l

Average Result (Real Estate Protocol): 4.6 pCi/l

Mail Results To: ____

Comments: ____

Laboratory Technician: T. McNully Analysis Date: 11-24-98

OPERATING INSTRUCTIONS FOR "E-PERM" DEPLOYMENT

1. Place the "E-Perm" on a shelf or table where it will not be disturbed for the exposure term of three to seven days. Unscrew the cap on top of the "E-Perm" canister. A spring inside the cap will lift the cap and a connected stem to raise a cover plate off the electret inside the canister. This turns the "E-Perm" on and begins the measurement.

2. On the form (on the reverse side), fill in the Device # of the "E-Perm" found on the bottom of the canister. This is actually the electret #. Also fill in the exposure location and note the "start date" and "start time". Keep this record available for entry of data when the unit is closed.

3. At the end of the exposure period (3 to 7 days), screw the cap back in place and note the "stop date" and "stop time".

4. Mail or return the "E-Perm" to the address given below for read-out. You will be notified of the results immediately by mail or by phone as you choose.

DO NOT UNSCREW THE BLACK BASE (ELECTRET) OF THE "E-PERM" FOR ANY PURPOSE AS IT MAY DAMAGE THE ELECTRET ELEMENT. THERE ARE NO INTERNAL PARTS REQUIRING ATTENTION.

INSTRUCTIONS FOR SELECTING SAMPLING LOCATION AND CONDITIONS

* Measurements should be made in the **lowest liveable area** in the house (ie. a basement, a bedroom, or a living room). Bathrooms, kitchens, laundry rooms, root cellars, garages, crawl spaces or sumps are **not** suitable.

* All windows and external doors in the house should be **closed** 12 hours before and during the sampling period, except for normal entering and exiting.

* Fans and ventilation systems that use outside air, such as attic fans and bathroom fans, should **not** be operated during the sampling period.

* Sampling should **not** be done on a very windy day (ie. wind speeds of twenty-five miles per hour or greater).

POLK COUNTY PUBLIC HEALTH UNIT
RADIOLOGICAL HEALTH OFFICE
225 AVENUE D, N.W.
WINTER HAVEN, FL 33881

(813) 291-5204

LU 9:30 144486 144608 1:10
AFF 10:00 144501 FIPR 144626 12:40
LU 11:08 " GAB 144629 2:05
AFF 11:30 144516 LV " 2:20
PCTTP 144632 2:30
LV " 2:32
(b) (6) 144645 2:55

11/13/98

10:00

Germain Gaboury
(b) (6)

1½ yr. resident LOT 97
(told gamma ~ 55-60 uR/h)
- don't eat from garden - fish
(Okra/tomatoes
- Radon - tested but UNK result.

- Call Harlan Monday re: testing fish & garden crops.
Floral Lakes
(across from Civic Center - Lot# 97)

1 comm. fisherman - access to lake - Nile perch.

J. Guidry - Based study on greens - worst case
3 mRem/yr - if all food from backyard
(Same from brickhouse)
(or 1 RT trip.)

Call Jerome if worried

Emmett Bolch

Radium in greens - But no problem

STUDY ALREADY DONE

SC (b) (6) Harlan → rather not → refers US to Guidry's report.
→ Guidry's report.
(Karen Stewart)
(b) (6)
(b) (6), → Talk to G. Nifong (RADIOACTIVITY IN FOODS GROWN (EXEC SUMMARY)

[veg & fish]

(NIFONG?) → (FISH) (NON-EXISTANT PROBLEM)

LUD 4633

GABOURY

Sun Rm - 6		12
LV Rm - 15		25
DIN Rm - 20		32
Kitchen - 19		30
Foyer - 18		29
Frnt Bed - 16		26
Frnt Bath 13		22
Rear Bedrm - 20		32
Rear Bath - 18		29
Rear Porch - 13		22
Dock (over water) - 7		13
Steps Down to Dock - 21		33
Garden - 7		13
W. yard - 9		16
Car Port - 9		16
Frnt Flower Bed - 10		18

mRem

280

@ 32 uR/h

24 hrs/dy

365 d/y

Avg indoor - 26 uR/h.

" outdoor - 19 uR/h.

228 mRem/y

Jerome Guidry

(b) (6)